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Ruefenacht

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(54) **ANNUAL CALENDAR MECHANISM FOR TIMEPIECE**

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(30) **Foreign Application Priority Data**

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(51) **Int. Cl.**
G04B 19/20 (2006.01)
G04B 19/24 (2006.01)

(52) **U.S. Cl.** **368/37**; 368/28; 368/77; 368/221

(58) **Field of Classification Search** 368/28, 368/35, 37, 77, 221, 220, 233
See application file for complete search history.

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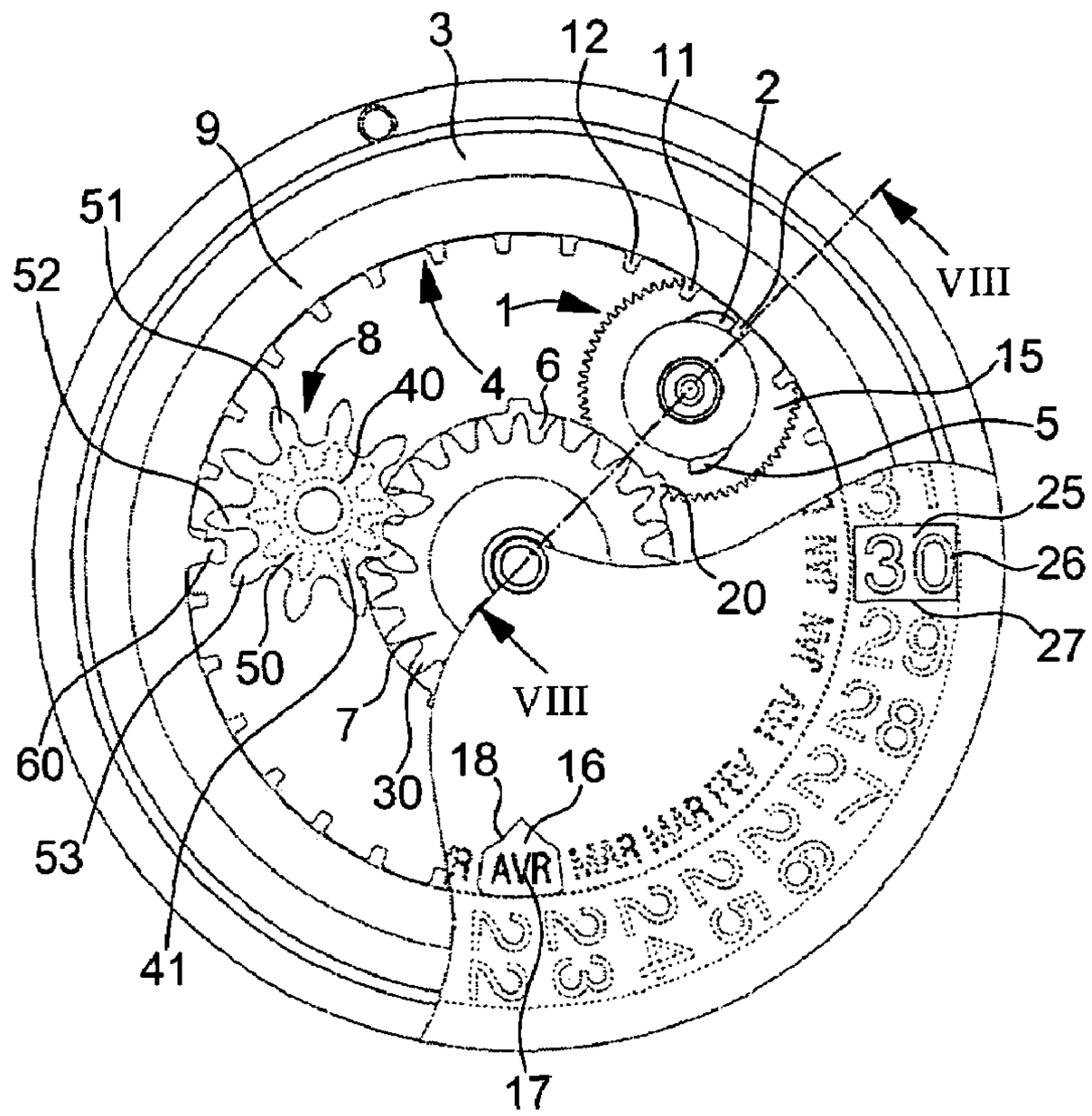
(57) **ABSTRACT**

The annual calendar mechanism comprises a drive wheel set (**1**) fitted with a first finger (**2**) driving a date disc (**4**) through one step once a day and a second finger (**5**) driving a plate (**6**) secured to an annual wheel (**7**) arranged coaxially to the date ring at the end of the months of less than thirty one days. An intermediate wheel (**8**) connects the annual wheel (**7**) to the date ring (**4**) at the end of each month. The annual wheel (**7**) comprises twice as many teeth (**30**) as there are months in a year and the intermediate wheel (**8**) comprises a first wheel (**40**) meshed with the annual wheel (**7**) and a second wheel (**50**) fixed to the first wheel, said second wheel being meshed, at the end of each month, with a snug (**60**) arranged inside the date ring (**4**).

5 Claims, 6 Drawing Sheets



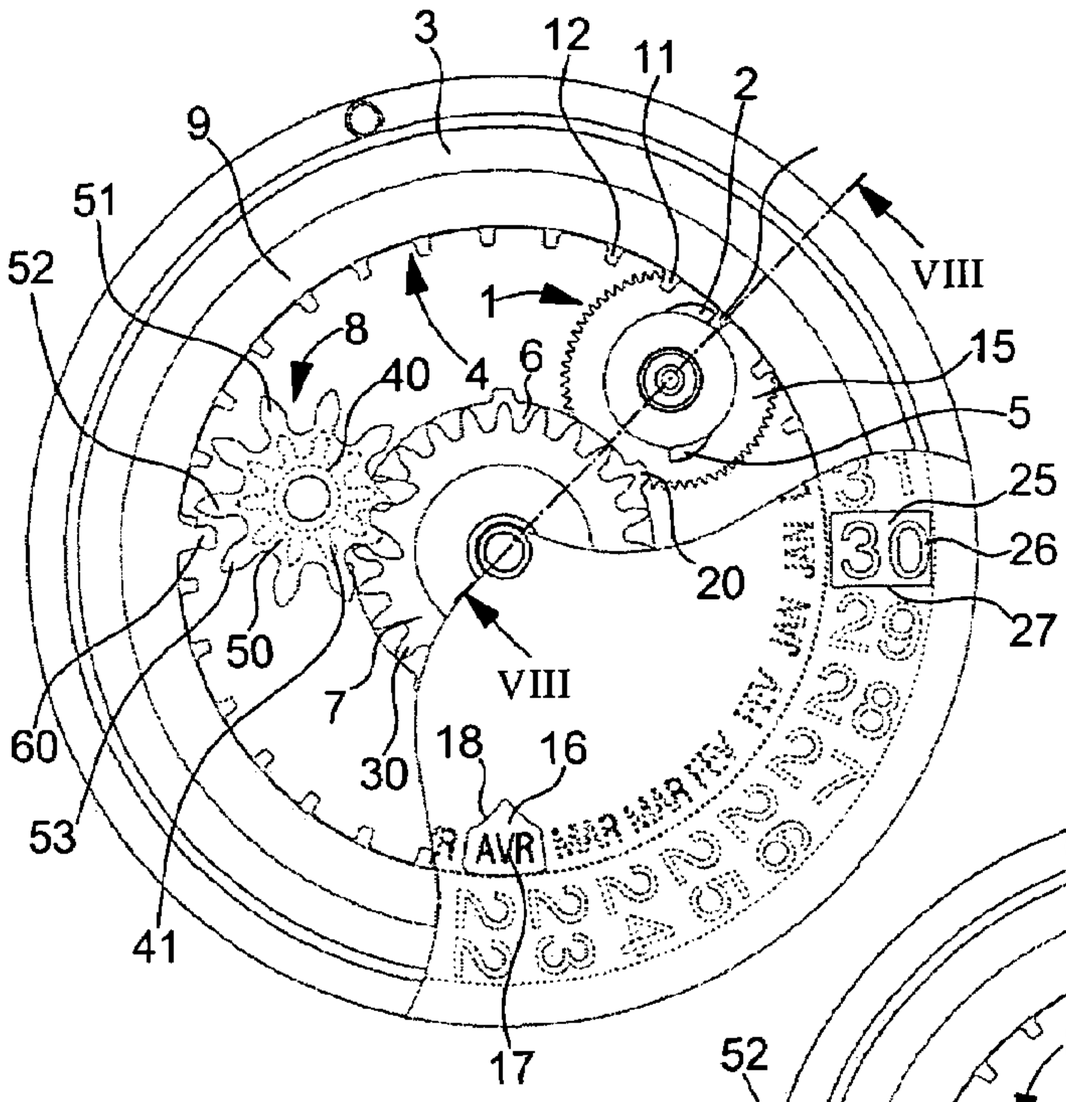
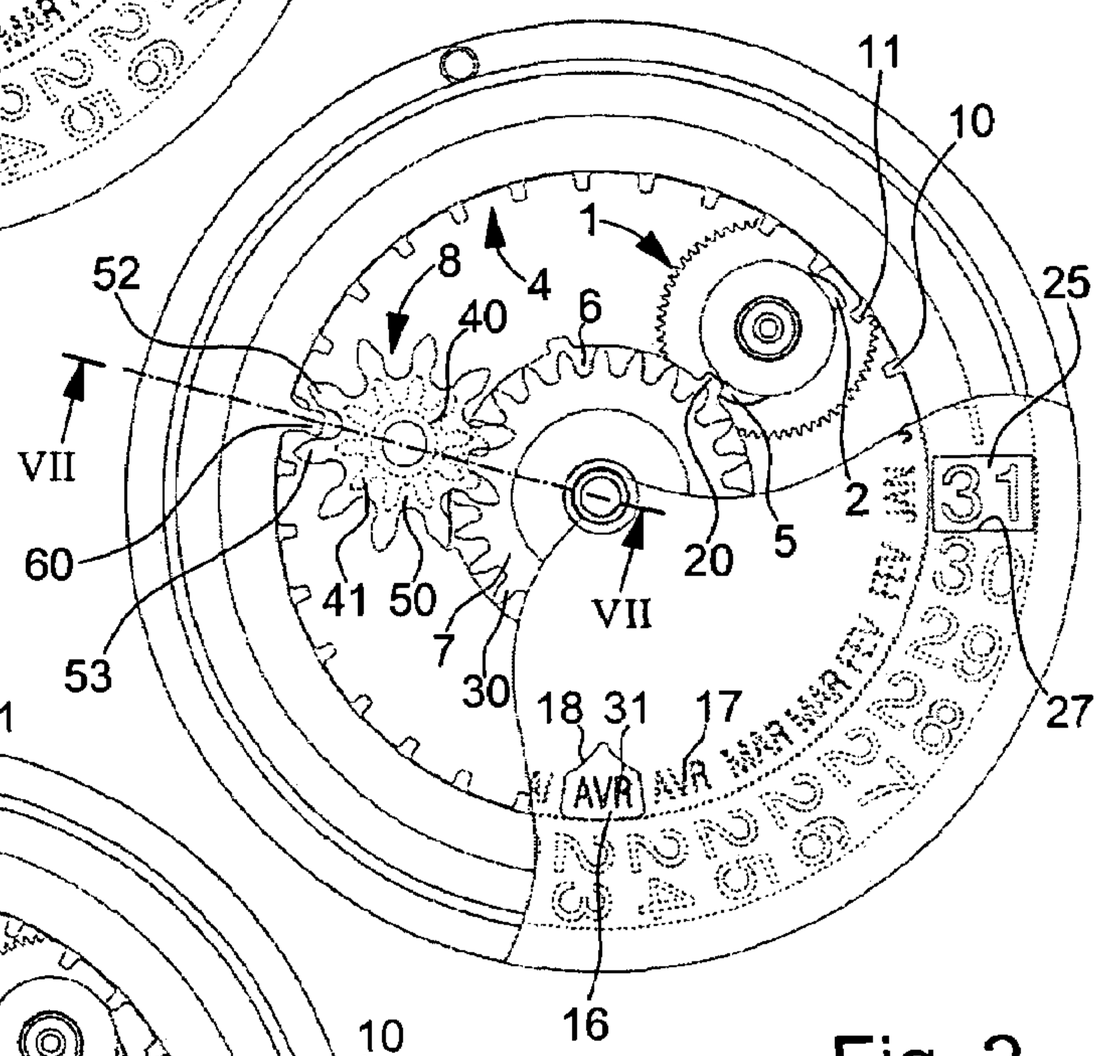


Fig. 1



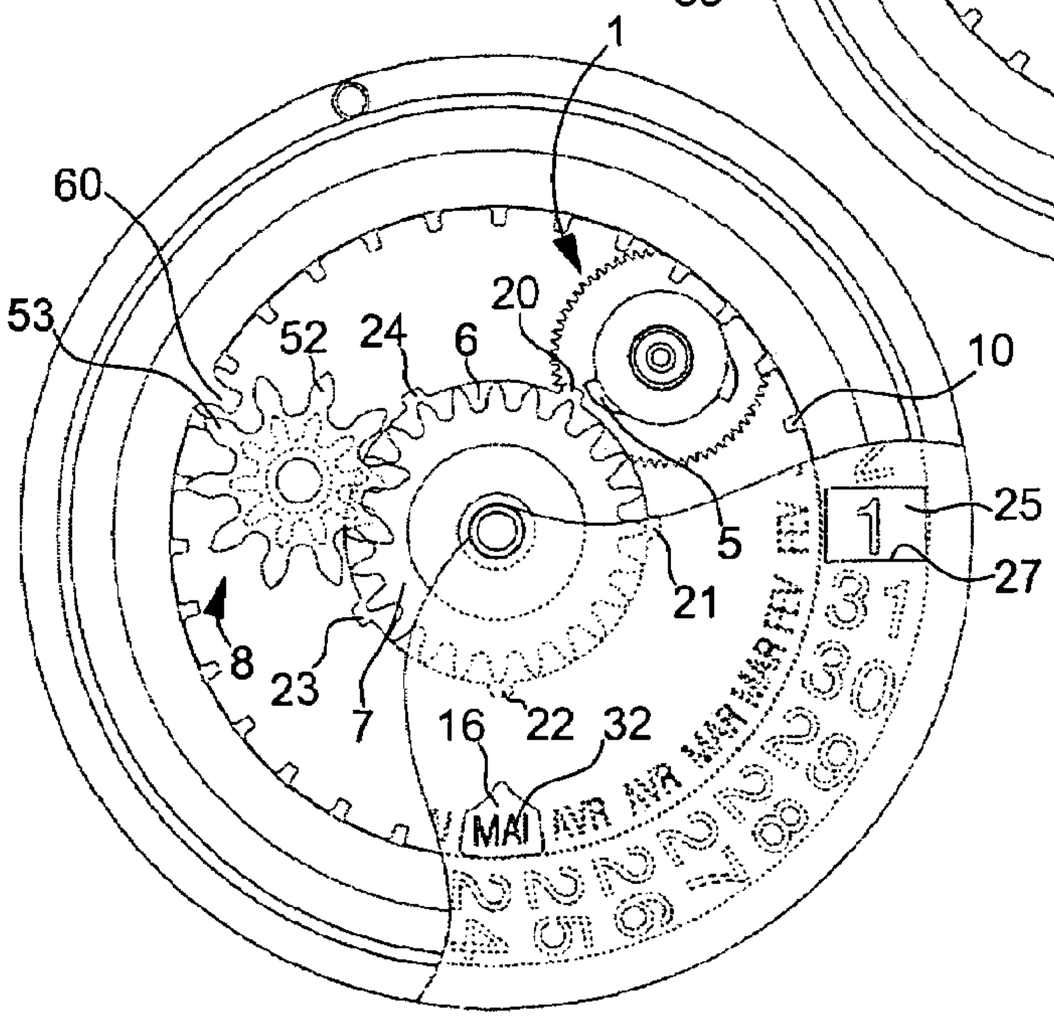


Fig. 2

Fig. 3

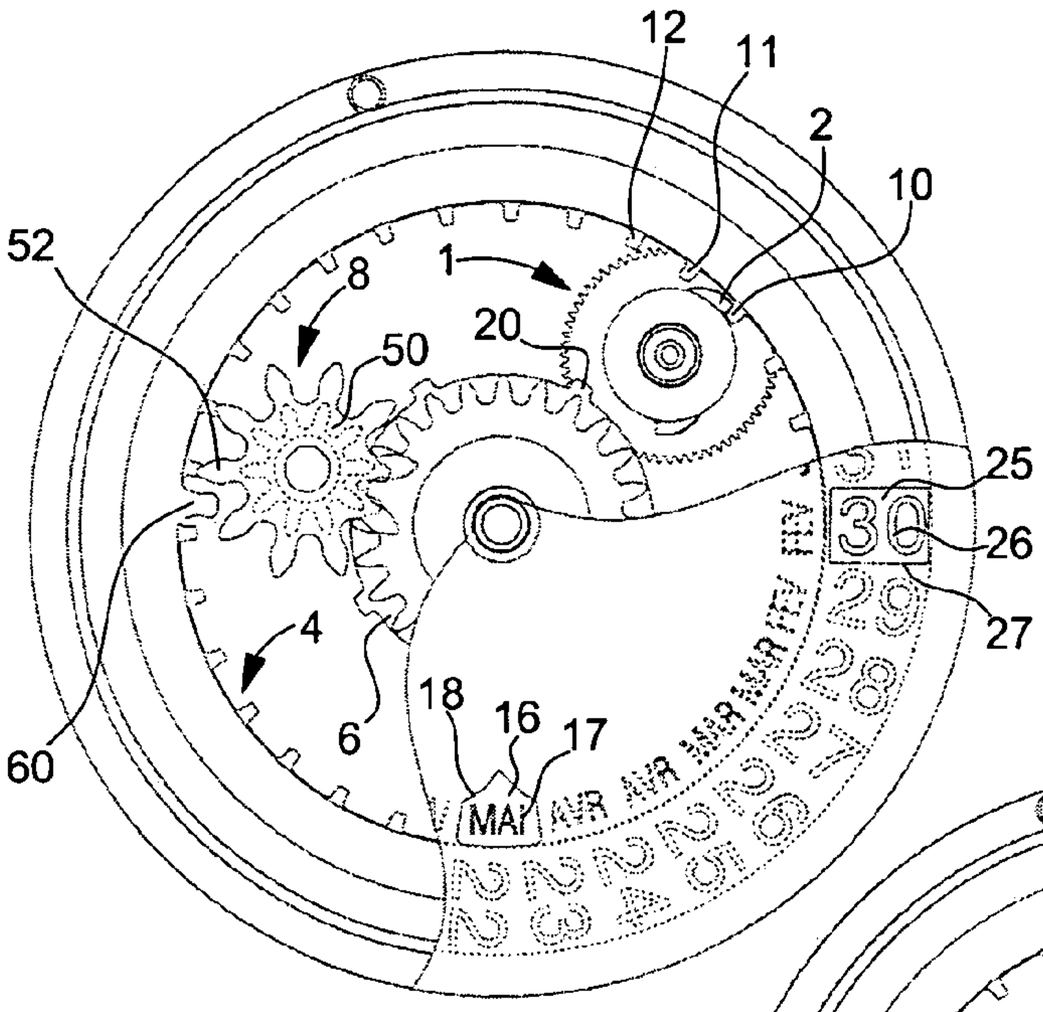


Fig. 4

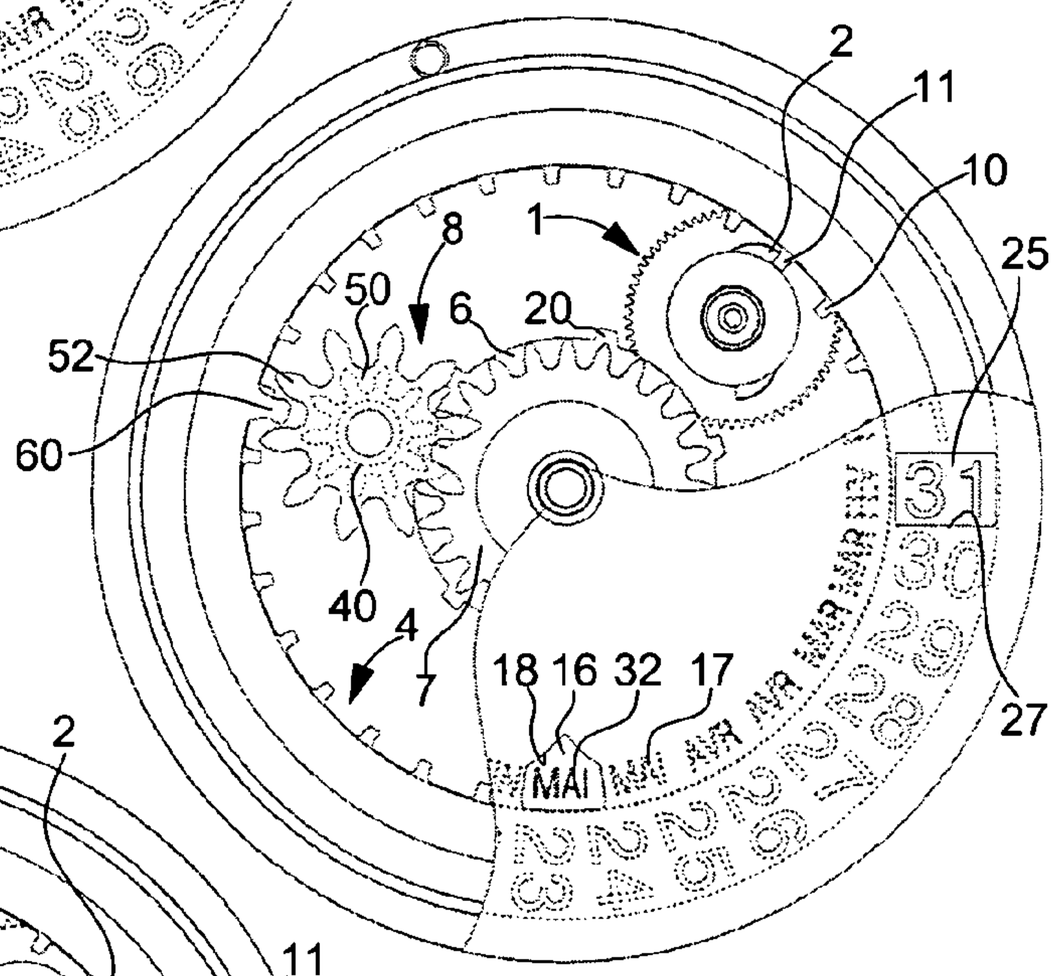


Fig. 5

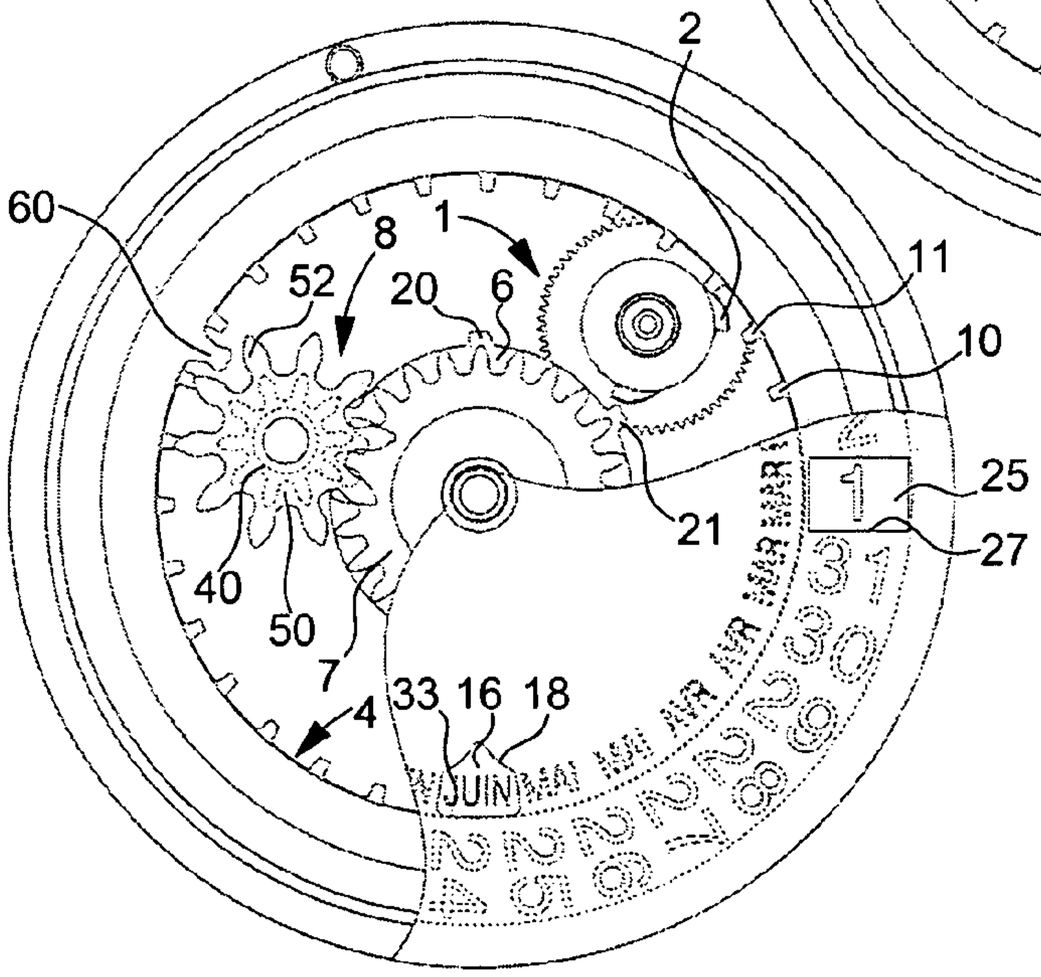


Fig. 6

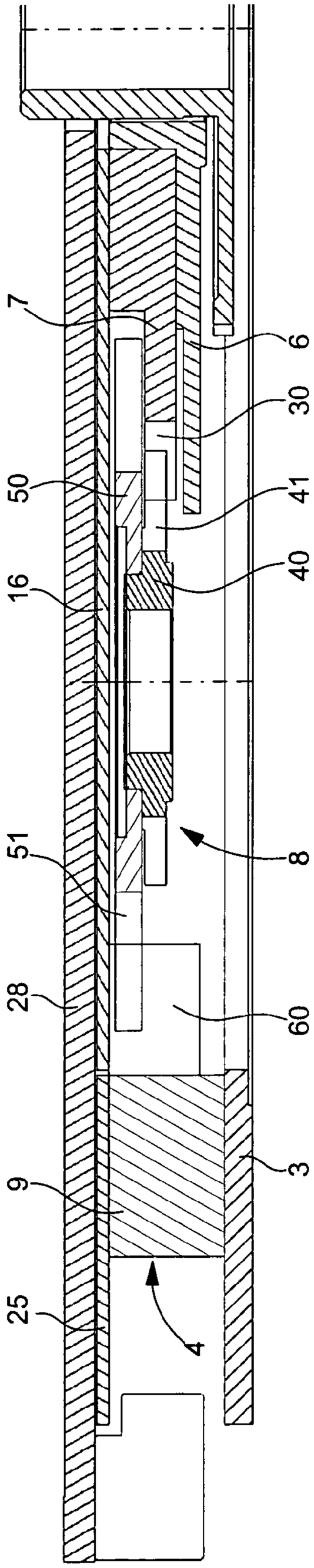


Fig. 7

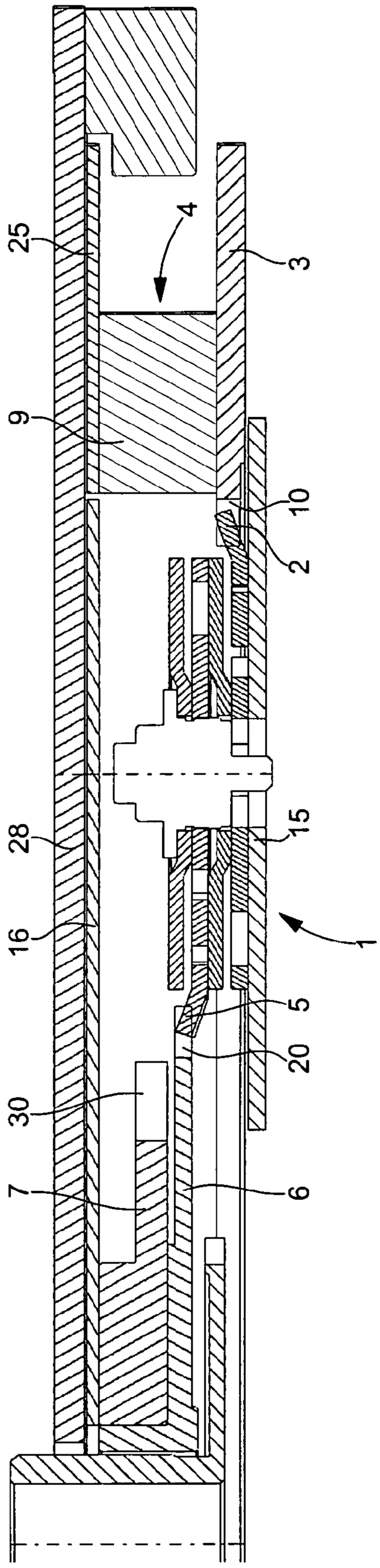


Fig. 8

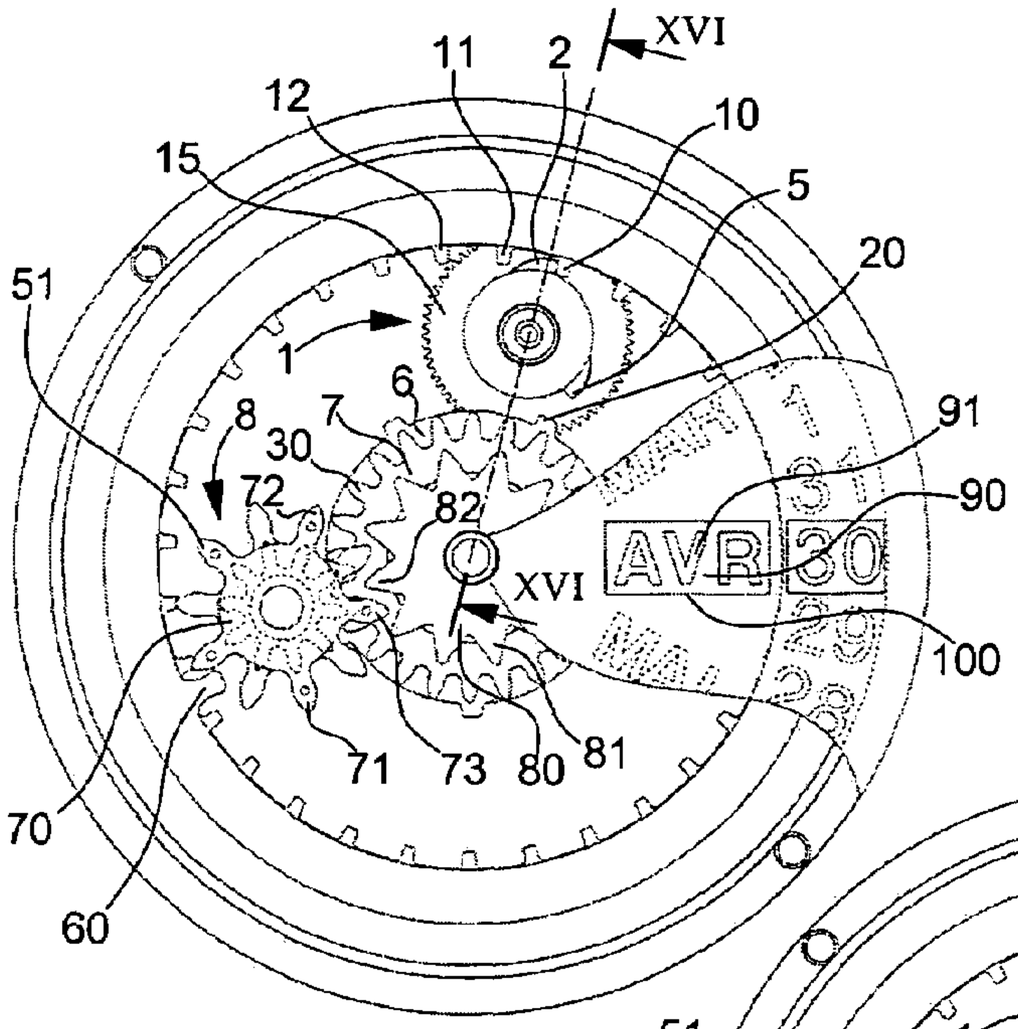


Fig. 9

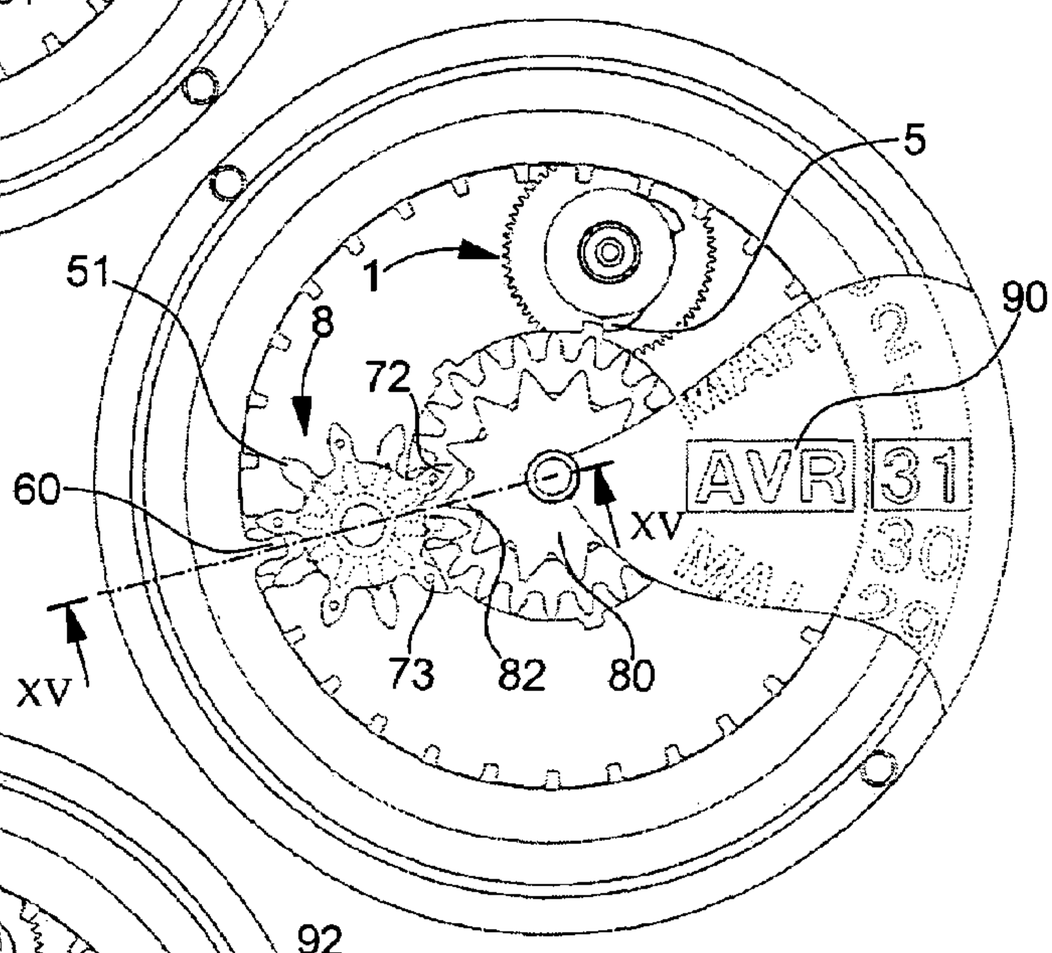


Fig. 10

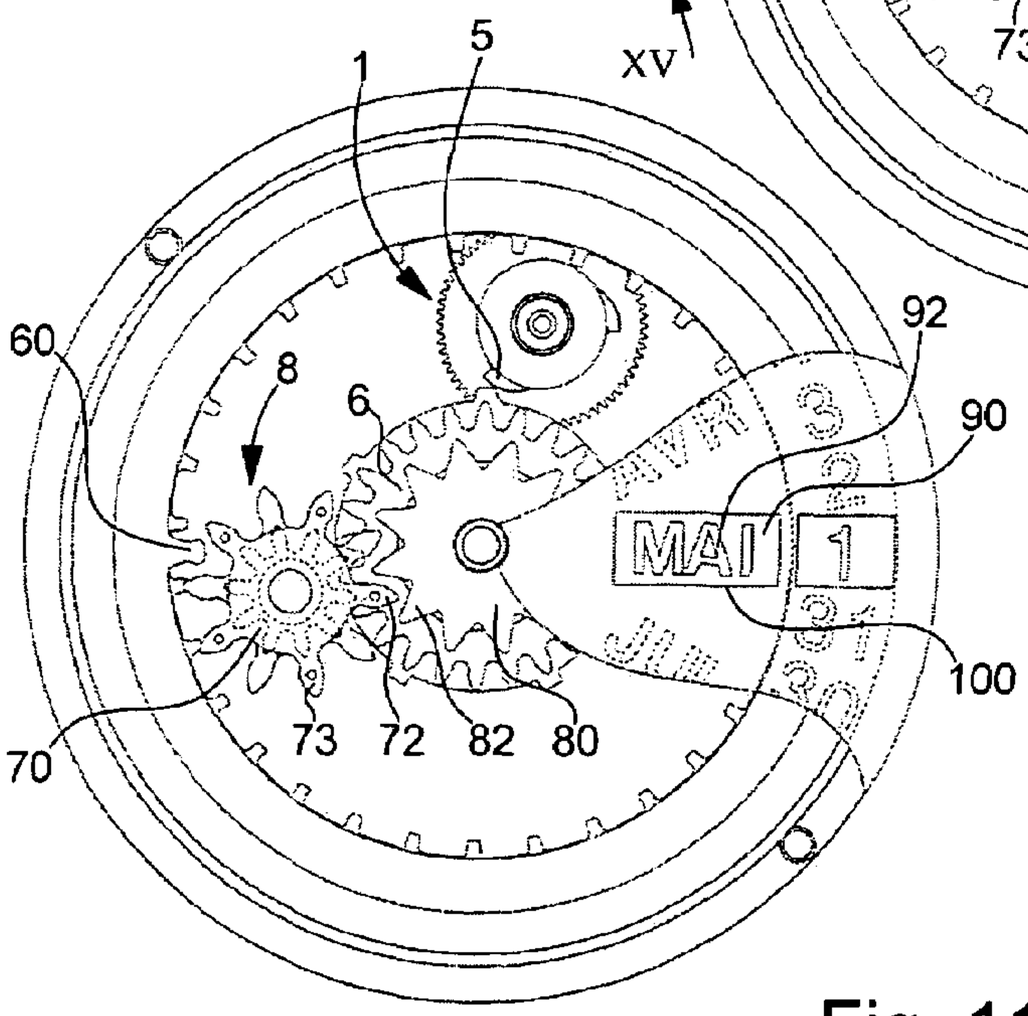


Fig. 11

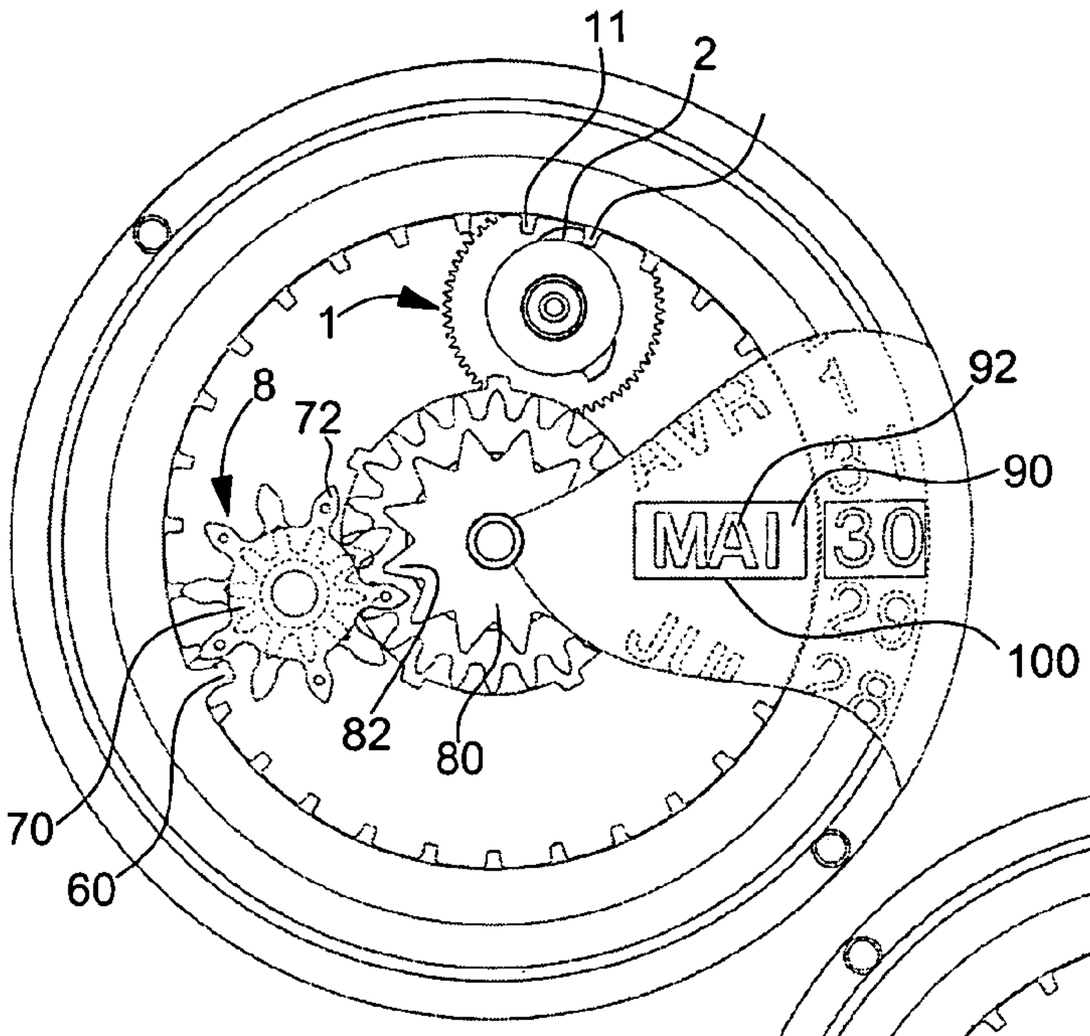
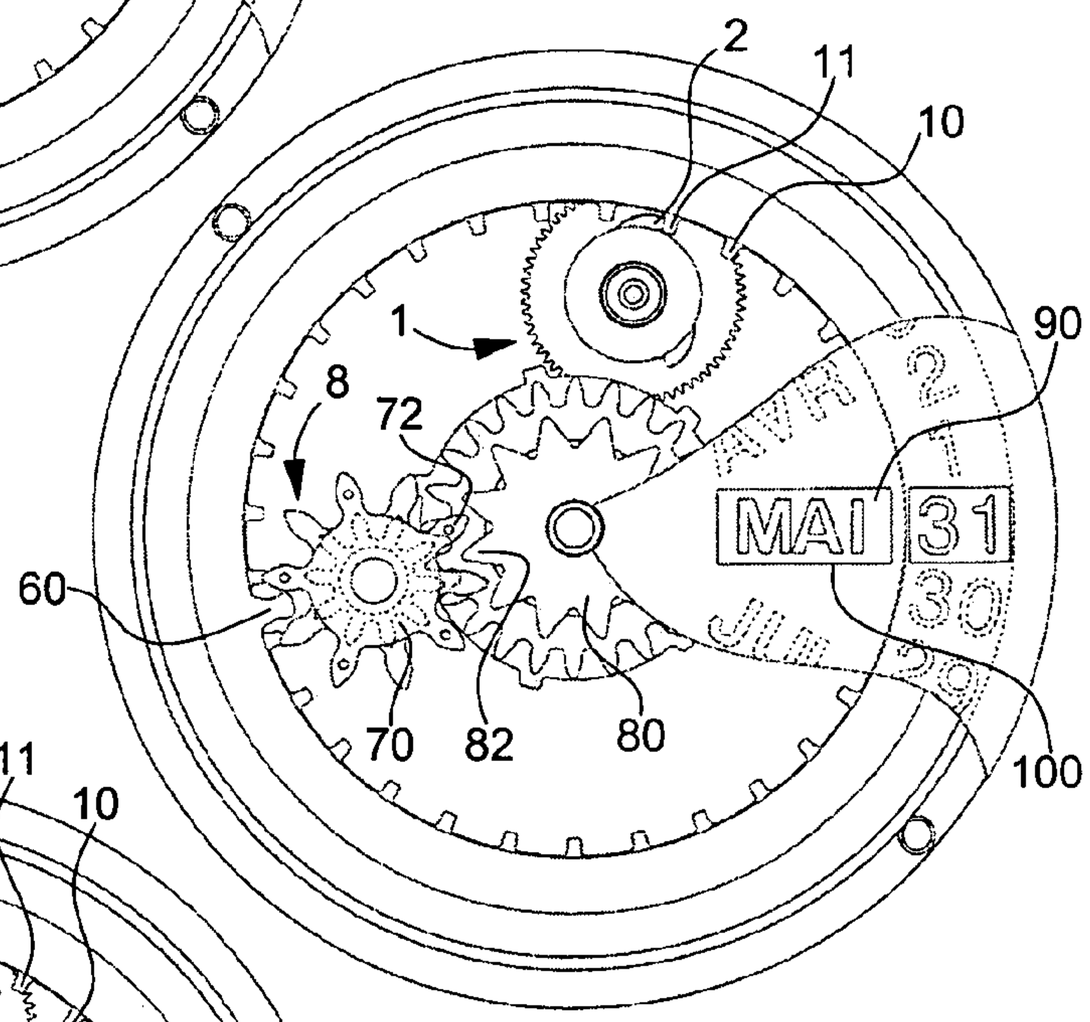


Fig. 12



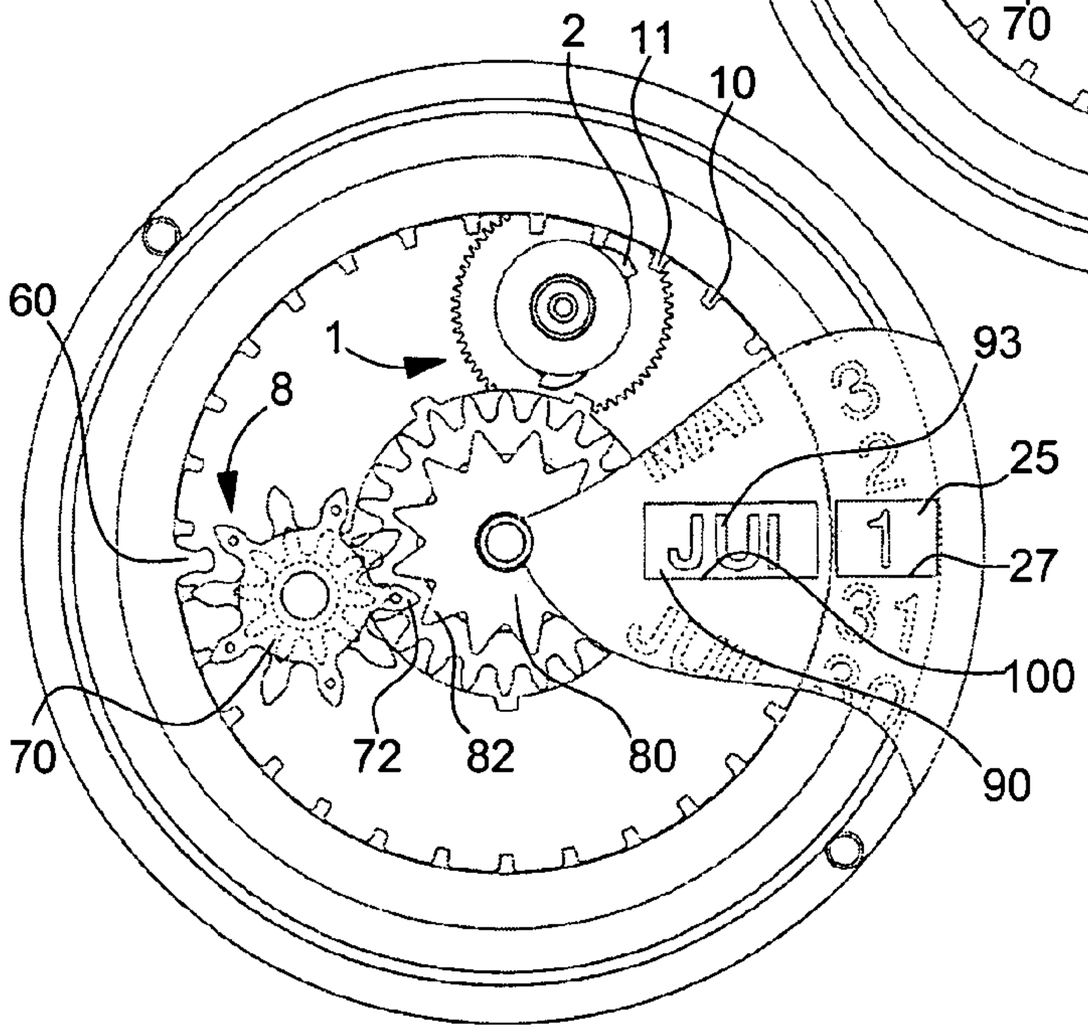


Fig. 13

Fig. 14

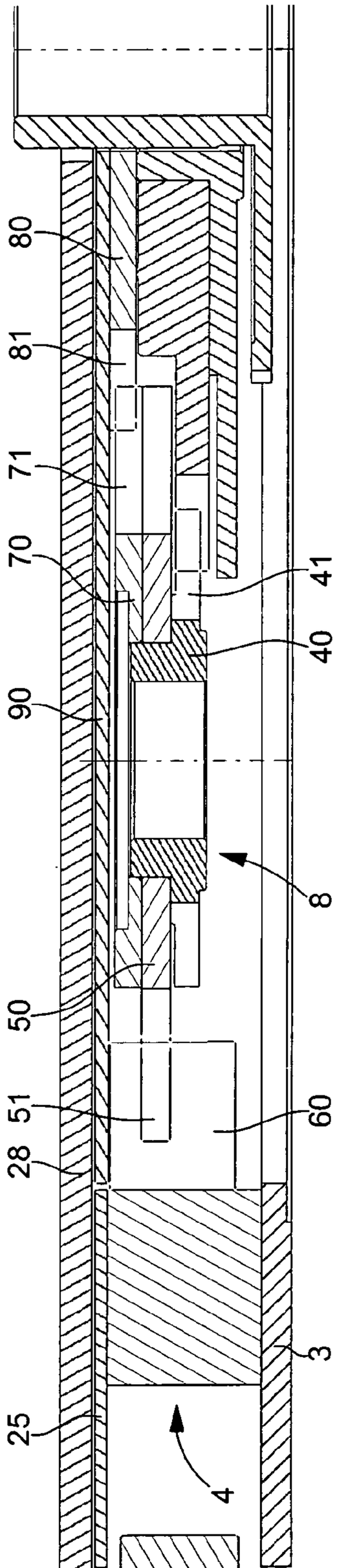

80
81
71
70
41
40
90
8
50
51
60
28
3
25
4

Fig. 15

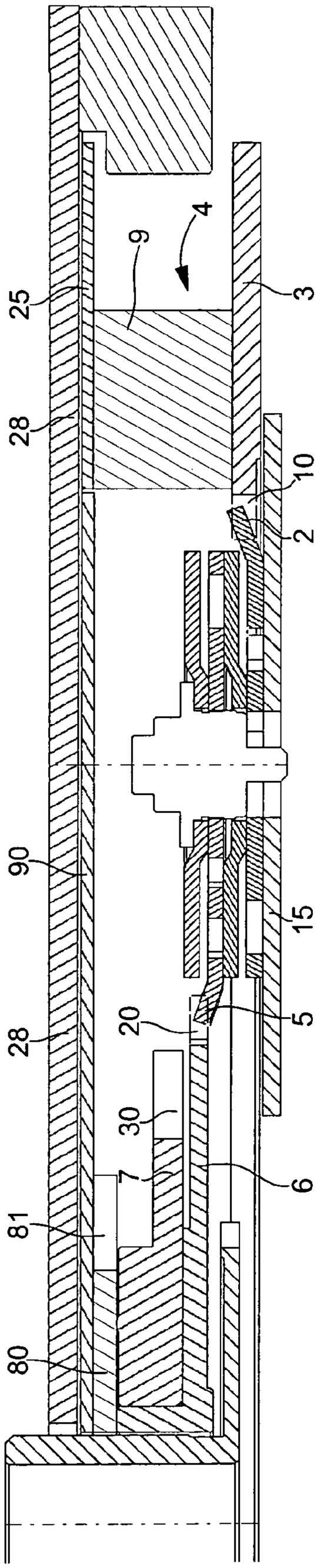

25
9
4
3
28
10
2
90
15
20
5
28
30
7
6
81
80

Fig. 16

ANNUAL CALENDAR MECHANISM FOR TIMEPIECE

The present invention relates to an annual date mechanism for a timepiece comprising a date drive wheel set completing one revolution in twenty four hours, this wheel set being fitted with a first finger driving, through one step once a day, a first stage of a date ring comprising thirty one inner teeth, said wheel set being fitted with a second finger driving through one step and at the end of a month of less than thirty one days, one of the five snugs of a plate secured to an annual wheel arranged coaxially to the date ring, said mechanism further comprising an intermediate wheel connecting, at the end of each month, said annual wheel to a second stage of said date ring.

Elements contained in the above definition are known from the Patent documents EP-A-1 251 412 and CH-B-684 815. A date drive wheel set completing one revolution in twenty-four hours is also found in these documents. In both documents, the drive wheel set is fitted with a first finger driving a date display through one step once a day and a second finger driving one of the five snugs fitted to a plate secured to an annual wheel through one step at the end of a month of less than thirty one days. An intermediate wheel, which connects the annual wheel to the date display at the end of each month, is also found in these documents.

More specifically, Patent No. EP-A-1 251 412 implements a ring with two stages carrying the date display and an annual wheel arranged coaxially to said ring. A first finger of the drive wheel set meshes with the thirty one inner teeth of a first stage of the ring, a second finger located at the end of a month of less than thirty one days on the path of a plate with five snugs on which there is fixed an annual ring comprising seventeen teeth. This annual ring meshes with an intermediate wheel that also comprises seventeen teeth, seven of which are thinned. The second stage of the ring carries two inner teeth, one of the teeth being thinner than the other. The assembly is arranged in such a way that at the end of the months of thirty-one days the annual ring moves forward one step and at the end of the months of less than thirty-one days, said wheel moves forwards two steps. Consequently, the month indicator comprises seventeen equal sectors. The name of the months with thirty one days (January, March, May, July, August, October, December) appear once and the name of the days with less than thirty one days (February, April, June, September, November) appear twice through an aperture cut into the timepiece dial.

The mechanism that has just been described has the drawback of a hybrid monthly indicator, the months with thirty-one days only appearing once through the aperture whereas the months with less than thirty-one days appear twice. Moreover, this mechanism requires the use of a relatively complex intermediate wheel since of the seventeen teeth that it has, ten are thick and seven are thinned, which involves particular complex machining of the intermediate wheel. This mechanism also requires the presence, on the second stage of the ring, of two snugs located at different levels, which complicates the manufacture of the stage. Finally, it should be mentioned that, when the mechanism is assembled, the intermediate wheel has to be placed in a very precise angular position to ensure proper synchronisation of the date display and corresponding month display.

CH Patent No. B-684815 implements more particularly an annual calendar wherein the date display is a hand. In this embodiment, the annual wheel is not central, but offset towards the top of the timepiece. This results in a complex

mechanism, the name of the months appearing on an off-centre disc meshed with an intermediate wheel comprising thirty-one teeth, thirty of which are truncated.

In order to avoid the drawbacks of the aforecited documents, in addition to satisfying the generic definition expressed in the first paragraph of this description, the present invention is characterized in that the annual wheel comprises two times more teeth than number of months in a year and in that the intermediate wheel comprises a first wheel meshed with the annual wheel and a second wheel securely fixed onto and arranged coaxially to the first wheel, said second wheel being meshed, at the end of each month, with a snug arranged inside the second stage of the date ring.

The features and advantages of the present invention will appear in the following description, made with reference to the annexed drawings and giving, by way of explanatory but non-limiting example, two advantageous embodiments of an annual calendar, and in said drawings:

FIG. **1** is a plan view of the annual calendar mechanism as it appears on 30th April at 23:30 in accordance with a first embodiment of the invention;

FIG. **2** illustrates the same mechanism as that shown in FIG. **1** on 1st May at 00:30;

FIG. **3** illustrates the same mechanism as that shown in FIG. **1** on 1st May at 02:00,

FIG. **4** is a plan view of the annual calendar mechanism as it appears on 30th May at 23:30 in accordance with the first embodiment of the invention,

FIG. **5** illustrates the same mechanism as that shown in FIG. **4** on 31st May at 23:30,

FIG. **6** illustrates the same mechanism as that shown in FIG. **4** on 1 June at 00:30,

FIG. **7** is a cross-section along the line VII-VII of FIG. **2**,

FIG. **8** is a cross-section along the line VIII-VIII of FIG. **1**,

FIG. **9** is a plan view of the annual calendar mechanism as it appears on 30th April at 23:30 in accordance with a second embodiment of the invention,

FIG. **10** illustrates the same mechanism as that shown in FIG. **9** on 1st May at 00:30,

FIG. **11** illustrates the same mechanism as that shown in FIG. **9** on 1st May at 02:00,

FIG. **12** is a plan view of the annual calendar mechanism as it appears on 30th May at 23:30 in accordance with the second embodiment of the invention,

FIG. **13** illustrates the same mechanism as that shown in FIG. **12** on 31st May at 23:30,

FIG. **14** illustrates the same mechanism as that shown in FIG. **12** on 1 June at 00:30,

FIG. **15** is a cross-section along the line XV-XV of FIG. **10**, and

FIG. **16** is a cross-section along the line VI-VI of FIG. **9**.

An annual calendar mechanism made in accordance with a first use of the invention will now be described with reference to FIGS. **1** to **8**.

This mechanism comprises, in a known manner, a date drive wheel set **1** completing one revolution in twenty-four hours. This wheel set **1** draws the drive force acting thereon from a kinematic chain driven by the timepiece movement the first link of which is illustrated by wheel **15**. Wheel set **1** is fitted with a first finger **2** which drives, through one step and once a day at midnight, a first stage **3** of a date ring **4** carrying thirty one inner teeth three of which bear the references **10**, **11**, **12**. Wheel set **1** is also fitted with a second finger **5** which drives, through one step and at the end of each month comprising less than thirty-one days, a plate **6** via one of its five snugs projections **20** to **24** (see FIG. **3**).

Plate **6** is secured to an annual wheel **7**, the assembly **6**, **7** being arranged coaxially to the date ring **4**. The Figures show finally that the annual calendar mechanism also comprises an intermediate wheel **8** which, at the end of each month, connects annual wheel **7** to a second stage **9** of date ring **4**.

The mechanism of the present invention differs from that which has been described hereinbefore in that it has two remarkable and original arrangements. First of all there is the annual ring **7** which comprises twice as many teeth **30** as there are months in a year. In other words, annual ring **7** comprises twenty-four teeth **30**. Finally, there is intermediate wheel **8** which comprises a first wheel **40** meshed with annual wheel **7**, teeth **30** of the latter meshing with the teeth **41** of first wheel **40**. Intermediate wheel **8** further comprises a second wheel **50** secured onto and arranged coaxially to first wheel **40**. This second wheel **50** is meshed, at the end of each month, with a snug **60** arranged inside the second stage **9** of date ring **4**. The Figures show that snug **60** is driven by teeth **51** which comprises second wheel **50**.

It will be noted here that the two wheels **40**, **50** that form intermediate wheel **8** are provided with teeth **41**, respectively **51**, regularly distributed over the periphery of the corresponding wheels, which involves very conventional machining, unlike the machining implemented for the intermediate wheel of the aforecited Patent No. EP-A1 251 412. The same comment can be made as regards snug **60** arranged inside the second stage **9** of date ring **4**, there being only one snug unlike the two snugs located on two different levels and necessary for the date mechanism of the aforecited document to work.

FIGS. **1** to **8** also show that the date ring **4** carries a date indicator ring **25** on which thirty-one figures **26** are affixed. These figures appear in turn through an aperture **27** cut into a dial **28** of the timepiece.

The same Figures also show that annual wheel **7** carries a month indicator disc **16** on which are affixed the names of the twelve months of the year **17**. These names appear in turn twice each month through an aperture **18** cut into dial **28**. It can be seen that the month indicator disc therefore comprises twenty-four equal sectors.

The operation of the annual calendar will now be described with reference to FIGS. **1** to **6** to explain the passage from one month to another, first of all for the months with less than thirty-one days, then for the months with thirty-one days.

FIGS. **1** to **3** illustrate the passage from one month to another for the months with less than thirty-one days. The passage from 30th April to 1st May is taken by way of example.

FIG. **1** shows the situation of the display on 30th April at 23:30. The first finger **2** of the date drive wheel set **1** enters into contact with the inner tooth **10** of first stage **3** of date ring **4**. The date indicator ring **25** causes a FIG. **26** to appear through aperture **27**, which is 30 (April). The month indicator disc **16** causes the name of the month of April to appear for a first time **17** through aperture **18**. Snug **60** arranged inside the second stage **9** of date ring **4** is close to tooth **52** of wheel **50** included in intermediate wheel **8**.

FIG. **2** shows the situation of the display on 1st May at 0030 hours. Driven by the first finger **2** of wheel set **1**, date ring **4** and its tooth **10** have progressed through one step. Indicator ring **25** briefly shows the FIG. **31** through aperture **27**. At the same time, snug **60** connected to date ring **4** has also progressed through one step driving wheel **50** via its tooth **52** in the clockwise direction. Wheel **40**, secured to wheel **50** to form intermediate wheel **8**, in turn drives annual

wheel **7** in the anti-clockwise direction and consequently plate **6** and snug **20** which is connected thereto. At this moment and following the rotation of wheel set **1**, second finger **5** thereof enters into contact with snug **20** of plate **6**. During this operation, annual wheel **7** has progressed through one twenty-fourth of a revolution, as has the month indicator disc **16**, which is connected thereto. The name of the month of April thus appears a second time **31**, but very briefly, through aperture **18**.

FIG. **3** shows the situation of the display on 1st May at 02:00. Continuing its rotation, wheel set **1** via its second finger **5** has driven plate **6** and its snug **20** in the anti-clockwise direction. Thus annual wheel **7**, secured to plate **6**, which was driven and now drives in its turn intermediate wheel **8** in the clockwise direction and its tooth **53** causes the date ring **25**, via its tooth **60**, to progress through one step. Indicator ring **25** shows the FIG. **1** through aperture **27**. By rotating, annual wheel **7** has driven month indicator disc **16** which then displays the month of May for the first time **32**.

It will be observed (see FIG. **3**) that the five snugs **20**, **21**, **22**, **23** and **24** each correspond to the months of less than thirty one days, namely the months of April, June, September, November and February. It is arranged that each of the snugs is located on the path of finger **5** of wheel set **1** at the end of the months that have just been cited. In order to do this, snugs **20** to **24** are necessarily placed around plate **6** at 60°, 90°, 60°, 90° and 60°. It will thus be observed that at the end of the month of February, a manual correction remains necessary. Finally, it will be noted that the date drive wheel set **1** can be of the semi-instantaneous passage type in which case a jumper spring (not shown) has to be arranged on the inner toothing of the date ring.

FIGS. **4** to **6** illustrate the passage from one month to another for the months with thirty-one days. Passage from 30th May to 1st June is taken by way of example.

FIG. **4** shows the situation of the display on 30th May at 23:30. Finger **2** of drive wheel set **1** enters into contact with the inner tooth **10** of date ring **4**. The date indicator **25** causes a FIG. **26** to appear through aperture **27**, which is 30 (May). The month indicator disc **16** cause the name of the month of May to appear for a first time through aperture **18**. Snug **60** of date ring **4** is close to tooth **52** of wheel **50** which forms intermediate wheel **8**. If the angular position of snug **20** of plate **6** is observed, it will be noted that the annual wheel has remained in the place it was on 1st May at 02:00 (see FIG. **3**).

FIG. **5** shows the situation of the display on 31st May at 23:30. Driven by finger **2** of wheel set **1**, date wheel **4** and its tooth **10** have progressed through one step. Date indicator ring **25** shows the FIG. **31** through aperture **27** and, at 23:30 on 31st May, finger **2** of wheel set **1** enters into contact with the inner tooth **11** of date ring **4**. While passing from 30th to 31st May, snug **60** connected to the date ring has also progressed through one step driving wheel **50** via its tooth **52** in the clockwise direction. Wheel **40**, secured to wheel **50** to form intermediate wheel **8** in turn drives annual wheel **7** in the anti-clockwise direction and consequently plate **6** and snug **20** which is connected thereto, in the same direction. During this operation, annual wheel **7** has progressed through one twenty-fourth of a revolution as has month indicator disc **16** which is connected thereto. The name of the month of May thus appears a second time **32**, but briefly, through aperture **18**.

FIG. **6** shows the situation of the display on 1st June at 00:30. By continuing its rotation wheel set **1**, via its first finger **2**, has driven date ring **4** through one step. The FIG. **1** of 1st June of date indicator **25** appears through aperture

27. At the same time, snug **60** of the date ring has driven wheel **50** in the clockwise direction via its tooth **52**. Wheel **40** forming intermediate wheel **8** with wheel **50** drives annual wheel **7** through one step in the anti-clockwise direction. Month indicator disc **16**, which is connected to the annual wheel, therefore also progresses through one step and causes the indication **33**, namely June, to appear in aperture **18**. It will be observed that plate **6** has also progressed through one step and therewith snug **21**, this snug thus preparing itself to fulfil its function at the end of the month of June which only comprises thirty days.

An annual calendar mechanism made in accordance with a second embodiment of the invention will now be described with reference to FIGS. **9** to **16**. This mechanism implements all of their elements used up until now and described hereinbefore to make the date mechanism in accordance with the first embodiment of the invention. Two additional elements have simply been added so that the name of the month appears only once in the aperture intended for such purpose.

Thus, FIGS. **9** to **16** show that intermediate wheel **8** comprises a third wheel **70** which is fixed onto second wheel **50**, which, with first wheel **40**, forms intermediate wheel **8**. Moreover, a star wheel **80** is mounted on annual wheel **7** so as to rotate freely thereon. Star wheel **80** comprises branches **81** which mesh with teeth **71** of third wheel **70**. The number of branches **81** and the number of teeth **71** that star wheel **80** and third wheel **70** respectively comprise, are arranged such that the star wheel progresses through one step when the third wheel progresses through two steps.

In corollary with the foregoing, star wheel **80** carries a month indicator disc **90** on which the names **91** of the twelve months of the year are affixed. These names appear once each month and in turn through an aperture **100** cut into a dial **28** of the timepiece. Indicator disc **90** thus comprises twelve equal sectors.

The operation of the annual calendar manufactured in accordance with the second embodiment of the invention will now be described to explain the passage from one month to another, without repeating all the details described with reference to the first embodiment but dwelling on the new elements and referring to FIGS. **9** to **16**.

FIGS. **9** to **11** illustrate the passage from one month to another for the months with less than thirty-one days, the passage from 30th April to 1st May being taken by way of example.

FIG. **9** shows the situation of the display on 30th April at 23:30. The month of April **91** affixed to indicator disc **90** appears through aperture **100**. Finger **2** of wheel set **1** is preparing to rotate the date ring and therewith snug **60** which will drive intermediate wheel **8** in the clockwise direction. The third wheel **70** of intermediate wheel **8** thus rotates in the clockwise direction. Teeth **71**, **72** and **73** of wheel **70** are marked in the Figures by a small circle in order to identify them and distinguish them from teeth **51** of the second wheel which is located below the third wheel. The calendar displays **30**.

FIG. **10** shows the situation of the display on 1^{st} May at 00:30. By rotating, the date ring displays very briefly the date of 31^{st}. Its snug **60** has caused intermediate wheel **8** to rotate. On passing from the position shown in FIG. **9** to the position shown in FIG. **10**, tooth **72** of third wheel **70** has not driven branch **82** of star wheel **80** and month disc **90** which is connected to said star wheel still displays the month of April.

FIG. **11** shows the situation of the display on 1^{st} May at 02:00. Intermediate wheel **8** driven by annual wheel **6** in turn driven by finger **5** of wheel set **1** makes the date wheel progress through one step via its snug **60**. The first of May is displayed by the calendar. On rotating, the third wheel **70**, via its tooth **72**, causes star wheel **80** to progress through one step via its tooth **82**. The month disc **90** connected to star wheel **80** also moves forward one step and the month of May **92** appears through aperture **100**.

FIGS. **12** to **14** illustrate the passage from one month to another for the months with thirty-one days, passage from 30^{th} May to 1^{st} June being taken by way of example.

FIG. **12** shows the situation of the display on 30^{th} May at 23:30. The month of May **92** affixed to indicator disc **90** appears through aperture **100**. Finger **2** of wheel set **1** is preparing to make the date ring rotation via its tooth **10**. On rotating, the date ring, via its snug **60**, will drive intermediate wheel **8** in the clockwise direction as well as third wheel **70** which is connected thereto. The calendar displays the date 30^{th}.

FIG. **13** shows the situation of the display on 31^{st} May at 23:30. The date ring has moved forward through one step and the calendar displays the date 31^{st}. Snug **60** of the date ring has made intermediate wheel **8** rotate. On passing from the position shown in FIG. **12** to the position shown in FIG. **13**, tooth **72** of the third wheel **70** has not driven branch **82** of star wheel **80** and the month disc **90** which is connected to the star wheel still display the month of May.

FIG. **14** shows the situation of the display on 1^{st} June at 00:30. By continuing its rotation, wheel set **1**, via its first finger **2** has driven the date ring through one step. The FIG. **1** of 1^{st} June of date indicator **25** appears through aperture **27**. Snug **60** has thus progressed through one step driving intermediate wheel **8** in the clockwise direction. On rotating, third wheel **70** via its tooth **72**, causes star wheel **80** to move forward one step via its tooth **82**. Month disc **90** connected to star wheel **80** also moves forward one step and the month of June **93** appears through aperture **100**.

The second embodiment of the invention, which has just been described, allows easier reading of the name of the month. In fact, month disc **90** only comprises twelve sectors, namely one sector per month which means that the name of the month can be considerably enlarged and its legibility increased. FIGS. **9** to **14** show this advantage clearly and especially the coordinated graphics of the date and month which have a similar size. It will be understood that this cannot be achieved if the month disc (FIGS. **1** to **6**) comprises twenty-four sectors in which case the name of the month has to be decreased relative to the figures displaying the date.

It will also be mentioned that the annual calendar mechanism according to the invention is very simple to manufacture since it comprises only conventional regularly cut wheel, the teeth that they carry being distributed in a uniform manner over the periphery thereof. It will thus be noted that the mechanism in question can very easily replace a simple date mechanism comprising only the date without any signification alteration to the basic calibre. This is particularly the case of calibre 2892 A2 marketed by ETA SA Manufacture Horlogère Suisse.

What is claimed is:

1. An annual calendar mechanism for a timepiece comprising a date drive wheel set completing one revolution in twenty four hours, said wheel set being fitted with a first finger driving through one step and once a day a first stage of a date ring carrying thirty one inner teeth, said wheel set being fitted with a second finger driving through one step and at the end of each month of less than thirty one days one of the five projections of a plate secured to an annual wheel

arranged coaxially to the date ring, said mechanism further comprising an intermediate wheel connecting, at the end of each month, said annual wheel to a second stage of said date ring, wherein the annual wheel comprises twice as many teeth as there are months in the year and wherein the intermediate wheel comprises a first wheel meshed with the annual wheel and a second wheel fixed onto and arranged coaxially to the first wheel, said second wheel being meshed, at the end of each month, with a snug arranged inside the second stage of the date ring.

2. A mechanism according to claim **1**, wherein the date ring carries a date indicator ring onto which are affixed thirty one figures appearing in turn through an aperture cut into a dial of the timepiece.

3. The mechanism according to claim **1**, wherein the annual wheel carries a month indicator disc onto which the names of the twelve months of the year are affixed, said names appearing twice each month in turn through an aperture cut into a dial of the timepiece, the indicator disc thus comprising twenty four equal sectors.

4. The mechanism according to claim **1**, wherein the intermediate wheel comprises a third wheel fixed to the second wheel and wherein a star wheel is mounted on the annual wheel so as to rotate freely thereon, the branches of the star wheel being meshed with the teeth of the third wheel, the number of branches and the number of teeth that the star wheel and third wheel respectively comprise being arranged such that the star wheel progresses through one step when the third wheel progresses through two steps.

5. The mechanism according to claim **4**, wherein the star wheel carries a month indicator disc on which there are affixed the names of the twelve months of the year, said names appearing each month once and in turn through an aperture cut into a dial of the timepiece, the indicator disc thus comprising twelve equal sector.

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